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Foreword

Electron probe x-ray microanalysis (EPMA) is one of the oldest yet still one of the most widely applied methods of spatially-resolved elemental analysis. Implemented as electron-excited x-ray spectrometry performed in the scanning electron microscope (SEM), EPMA achieves spatial resolution both laterally and in-depth, typically at the micrometer scale in bulk specimens, and, under special circumstances, spatial resolution can be reduced to the range of nanometers. The popularity of EPMA arises from the extraordinarily broad range of applications: What other technique can solve problems as diverse as determining the nature of the microscopic white crystals that form under certain conditions on the surface of Wisconsin cheese (calcium phosphate, apatite) or elucidating the time-dependent behavior of phase-stabilizing, dimension-preserving gallium in the microstructure of plutonium to preserve the safety and efficacy of the Nation's arsenal of nuclear weapons?

Leading experts in EPMA from industry, academia, and government, from the U.S., Canada, Mexico, and Europe met at the National Institute of Standards and Technology, April 8-11, 2002, to participate in a workshop on "The Accuracy Barrier in Quantitative EPMA and the Role of Standards" co-sponsored by the Surface and Microanalysis Science Division of the Chemical Science and Technology Laboratory and the Microbeam Analysis Society (U.S.). The workshop sought to reach an understanding of the present state of quantitative EPMA, especially to identify those factors that limit the accuracy of the method at the current level of approximately 2 % relative uncertainty. A second task sought to develop a roadmap for future progress. Speakers considered the limitations of current EPMA instrumentation, the theoretical basis of EPMA physical correction procedures, the extension of EPMA into new classes of electron beam instrumentation such as variable pressure/environmental scanning electron microscopes and low voltage SEMs, and the critical role of standards to extend quantitative measurements for specific applications such as protective coatings for high performance materials used in aerospace applications. An industry panel discussion identified vital needs to which NIST might respond, such as new measurements of the relative weights of x-ray peaks from low energy (< 2 keV) L- and M-shell x rays.

The Workshop is dedicated in honor of the keynote speaker, Kurt Heinrich (NIST, retired), who devoted a major portion of his long NIST career to understanding the EPMA measurement process and promulgating robust analytical methods and standards to the international scientific community. Kurt is internationally recognized as one of the "founding fathers" of the EPMA technique, and we are pleased to have had his participation in this Workshop.

With more than 100 attendees filling the lecture room, the meeting was broadcast on the Web to accommodate those who could not attend or were turned away due to space limitations. The 4 day workshop was a gratifying success with excellent presentations by the speakers (several submitted papers for this publication) and the ensuing discussions. We want to thank the speakers again for their superb efforts. We'd also like to thank the many NIST staff members, from the Conference Program Office, the Information Services and Computing Division, and the Microanalysis Research Group (Surface and Microanalysis Science Division) who helped to make this a successful workshop.

When reading these proceedings papers, readers may encounter measurement terms that are not conventionally used in the microanalysis community. On the next page is an explanation by Theodore Vorburger, Chief Editor of the *Journal of Research of the National Institute of Standards and Technology*, for colleagues in microanalysis who may be reading the *Journal* for the first time.

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Special Issue Editors